Self-assessment BSc programme Environmental Sciences 2013-2017

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Self-Assessment

BSc programme
Environmental Sciences
2013-2017

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0. General information

Institutional data	
Name	Open Universiteit (Open University of the Netherlands)
Status	Brin22NC
Funding	Government-funded university
Institutional audit	Positive. Expiry date: 15-01-2021. Audit trail: BSc Milieu-natuurwetenschappen (2015)

Programme data	
Name	B Milieu-natuurwetenschappen (B Environmental Sciences)
Number in CROHO	56988
Funding	Higher level funded Science programme
Accreditation	Positive: St1 Satisfactory, St2 Good, St3 Satisfactory. Date judgment: 31-07-2014; Expiry date: 30-07-2020
Orientation	academic
Level	Bachelor
Grade upon graduation	Bachelor-of-Science (BSc)
Number of credits of programme	180 EC
Propaedeutic diploma	Yes, 60 EC
Enrolment requirements	No enrolment requirements.
Place	Heerlen, NL (main campus).
programme is offered	Online tutoring, quarterly f2f tutoring at Utrecht, and examination and advice facilities at 21 study centres in the Netherlands and in Belgium Flanders.
Study mode	part-time (online education)
Language of instruction	Dutch, a third (45 EC) of the post-propaedeutic programme is in English
Variant	The liberal academic variant is offered as Liberal Arts and Sciences Bachelor
Direct Entry to Master*	MSc Environmental Sciences (OU and other universities), and by Individual Pre-Master's Bridging and Short Bachelor Transfer programmes
Programme leader	Dr ir Angelique Lansu, UD MST Science (as from 01-01-2014)

Open Universiteit
The Open Universiteit (OU) offers academic BSc and MSc programmes in a variety of disciplines. As such, the OU is unique in the Netherlands in its focus on educating adults (i.e., persons of 18 years or over) by means of part-time, online education. The OU has undergone a major transformation process recently. The new focus on personalized online active learning methods is embedded in a new educational BSc system (project yOUteach: OER 2016/2017 till 2018/2019) and supported by a new digital learning environment (yOUlearn, as of Sept 2016). This innovation process enabled us to improve the BSc programme, following the advice of the previous external assessment panel (Appendix C).

Organisational embedding
The BSc programme *Milieu-natuurwetenschappen*, offered by the Faculty of Management, Science and Technology (MST), is 1 of 4 BSc and 5 MSc programmes in management science, environmental sciences, computer and data sciences and in business management IT. Most lecturers are part of the Science Department, and are also involved in the MSc *Environmental Sciences*. Each programme has a programme leader responsible for programming, while the full professors are responsible for coordination of tasks among the lecturers of their research group. Together with the chair of the Science Department, the BSc and MSc programme leaders constitute the (informal) programme management. Both programmes have a Curriculum Committee (cmte) consisting of all lecturers. There is a Programme cmte and an external Advisory Board. The programme leaders are members of the Educational cmte of the MST faculty, chaired by an MST faculty management team member, which focuses specifically on educational affairs. The MST faculty has one Examination Board covering all MSc and BSc programmes; decisions on admission

and student-specific curricula are prepared by a subcommittee, the Admission cmte, covering both programmes in Environmental Sciences. Both programmes and their lecturers are actively supported by the OU Expert Centre on Educational Affairs and Professionalization (ECOP).

Open enrolment
The OU has open enrolment for all people of 18 years and over to each BSc course, except for designated courses with entry requirements: the propaedeutic laboratory and the BSc's thesis and its preparation. After successful completion of the academic BSc students can continue with the MSc Environmental Sciences. Due to the OU's open enrolment policy, students do enrol for individual courses with intentions ranging from a first try on an academic course of interest to a full BSc degree programme. Other students are professionals with HE degree or certificates: these students enrol in the BSc as part of an individual pre-master's bridging programme (*=schakel of premaster*) or a short BSc transfer programme (*=BSc met vrijstelling*). Our BSc students predominantly are employed and at the start of their careers (at BSc graduation: 68% < 30 year). Most study out of interest in science and/or sustainability issues (87%). Students have reported their findings on the programme in the Students' Chapter (Appendix B).

Student numbers
Appendix D2 provides detailed indicators of enrolment, study success per course and graduation.

Student numbers (2013-2017) remain constant at 30 new OU-students yearly, who are defined as degree students once they start a fourth BSc course. Per year, appr. 21 students finish their propaedeutic certificate, and, on average 4 years later, 14 students graduate for the *BSc Milieu-natuurwetenschappen*.
Looking at course-level, completely different numbers of students emerge. Each year, a total of 688 students take one or more BSc courses (1036 course enrolments). Of these, appr. 155 students start with the introductory course (a fifth) and appr. 257 students (a third) are new OU-students (25% on propaedeutic and 34% on post-propaedeutic courses). Follow-up enrolments are: appr. 70 students (1/3) for a second course, 40 (half) for a third and 30 (3/4) for a fourth BSc course. Student numbers on key courses serve (Appendix D2) as indicators for the heterogeneity in study background and individual intentions to study: appr. 51 students yearly (degree, transfer and bridging) study the final propaedeutic course, 18 degree students take a BSc thesis or thesis preparation course, and 12 degree students enrol into the propaedeutic lab (those without a HE science background).

BSc student satisfaction scores are consistently high, with top-rankings of the programme in the successive 2015-2018 Keuzegids (Appendix H4). However, low student and programme efficiency rates and low numbers of BSc and MSc graduates remain a concern. Therefore, programme management has developed new initiatives: a concise BSc core curriculum with tutoring rostered in quarters/semesters ('yOUteach'), a renewed BSc introductory semester offered twice per year, and particularly a short bachelor's degree transfer and a pre-master bridging programme for graduates from universities of applied sciences (hbo) and other academic programmes. The first results of both transfer and bridging programmes are promising: since 2016, 30 students yearly were admitted to the transfer and 50 to the pre-master's bridging programme. This is an increase of 11% in new enrolments on post-propaedeutic courses. The concise pre-master courses for hbo-graduates increased from 6 (at course start in 2015) to 22 enrolments for 2017.

Study success rates show the same pattern: over the period 2013-2017 the amount of students yearly that succeeded in at least one course increased with (increasing at a rate of 15%) A mean of 223 students/ year are credited > 5 EC and 181students are credited <15 EC. A mean of 43 students pass >15 EC yearly, of which 14 students pass ≥22,5 EC (comparable to study pace of ≥45 EC fulltime Binding Study Advice (BSA). Thus, appr. 43 students per year are considered to be degree students, which are personally mentored and monitored on their study planning by the study advisor.
The challenge of the new educational system yOUteach (as of Sept 2016) is to enhance this follow-up enrolment by emphasizing cohort scaffolding. Preliminary 2017/2018 results show a 20% increase in 'course efficiency rate, and a 30% increase in follow-up enrolment in the BSc. Extrapolation of these numbers show that we are on our way to realize the projected numbers of at least 50 new entries (*opleidingsplan* 2016-2019), 25 BSc graduates and 20 pre-master students per year.

Standard 1: Intended learning outcomes

Vision and orientation
Basis of the 2016-2019 renewal, called 'yOUteach', of the BSc programmes into part-time flexible personalised learning programmes is the educational vision of the OU (OU, 2014). The new programmes are academic, based on active online learning, and intertwined with research. The aim to offer a BSc degree programme *milieu-natuurwetenschappen* is to prepare students for future academic knowledge work in the field of environmental sciences and sustainability (ESS) (opleidingsplan, 2016), and to train professionals at BSc level for work in a team on diagnosis, research and intervention of environmental problems (competence road map (Appendix E1). Students aspiring to a degree are supported to realize this ambition in a reasonable time by active online learning: self-regulated learning scaffolded by rostered learning tasks, online tutoring and cohort monitoring. Flexible study schedules at variable tempi, dedicated course materials and recorded lectures allow students with diverging learning objectives or functional limitations to study individual courses at either higher or lower pace. By stacking courses it is possible to obtain a propaedeutic certificate or bachelor degree.

Our BSc graduates can contribute to the scientific mapping of environmental problems and to further defining them (diagnosis). Furthermore, they can contribute to the scientific investigation of problems and report to the professional field (research), and finally, they can contribute to the design of strategies for sustainable solutions on environmental issues (intervention). In addition the programme pays attention to professional academic skills, i.e. project-based collaboration in multidisciplinary teams, dealing with uncertainties, stakeholders and transboundary perspectives, academic and professional reporting (orally and written), and reflection on his/her own role as learner and (future) environmental professional. The intended learning outcomes are tailored to the work field of analysis, consultancy , governance and businesses in the ESS domains (examples of employers: Appendix F3)

Dutch referential framework: level
The Dutch field of ESS has been described in the Dutch referential framework (ICM, 2017, Appendix C). The programme's position in this framework is driven by three main factors: (1) the large heterogeneity of the student population because of part-time online learning and open enrolment, (2) the absence of any admission requirements (no Dutch vwo-diploma or equivalent required), including prerequisites in Science, Technology, Engineering and Mathematics (STEM) subjects, and (3) the part time nature of the 180 EC programme with an individual, flexible pace of study (by default offered at 30 EC/y, 15 EC/y or at a personal higher/lower pace).

When comparing the programme's Intended learning outcomes to the Dutch referential Academic framework for Environment and Sustainability (ES), a clear fit with the learning outcomes emerges(Appendix E3). When redefining the intended learning outcomes, aspects such as scientific concepts, theories, methodological approaches and strategies towards transition-oriented intervention will be explicitly included. Compared to the referential framework, we have integrated the Dublin descriptor on learning skills more strongly in our learning outcomes, in terms of reflection on own study and work or on future learning and actions towards labour market opportunities. Based on our faculty's research programme, we expect to redefine our intended learning outcomes towards socio-ecological systems theories (or human-environmental systems analysis), energy transition practices and resilience methodologies, which are currently not part of the Dutch referential framework.

To accommodate the heterogeneous interests of our students, the BSc focusses on a standardised core curriculum with a broad array of environmental and interdisciplinary courses, while it does not offer a thematic programme or specialisation tracks as other Dutch BSc ES programmes do. Thus, our programme offers students the opportunity to broaden their view on current ES issues in the areas which are covered by the faculty's research fields and expertise, e.g. *environmental chemistry and physics, life sciences and ecosystem assessment, environmental modelling, nutrition and food security, climate change, regional and water governance, energy, and ecotoxicology*.

As place and pace is highly flexible in our programme, we choose not to offer a separate honours cohort. However, in-depth assignments can be requested from the examiner. The MST faculty offers a liberal BSc programme as a Liberal Arts and Sciences track. Up to now, appr. 1 student per year enrols in this variant, indicating that students experience sufficient opportunities within the BSc ES programme to realise their personal learning aims.

The open admission and the absence of prerequisites in STEM subjects distinguishes the programme from other BSc ES programmes and creates some

challenges for its structure and intended learning outcomes. The heterogeneity amongst starters with respect to prior STEM pre-academic education is large. Before the formal start of the introductory semester, self-assessment and remediation on Mathematics is offered, and lecturers provide feedback on facultative assignments. The coaching and learning tasks in the introductory courses provide students with knowledge on the earth system and disturbed relationships in human-environmental systems, while tasks on learning and reflection in regional tutored peer meetings offer insights into which academic knowledge and skills should be remediated. Some remediation on chemistry and biology is offered as facultative, extra learning tasks.

The BSc mainly caters for the Dutch linguistic region; most students live in the Netherlands (80%), Flemish-Belgium (16%) or abroad (4%). In the BSc students are faced with English and Dutch, in all facets: reading, listening, speaking and writing. The language of instruction is Dutch; a third (45 EC) of the post-propaedeutic programme is fully in English. We assume that students at enrolment can write a coherent consistent report in Dutch for test assignments (open questions, essays), which is often not the case. In this respect, the successful completion of the propaedeutic key courses (Appendix D2) is important for remediation and testing of the academic writing skills. The propaedeutic certificate is a mandatory prerequisite for the 2nd BSc year's thesis preparation course. At the propaedeutic level, students are required to use English passively, at the post-propaedeutic level active use of English is expected, as an important factor for connecting with current research findings (part of the learning materials) and in view of a possible ES MSc. The English post-propaedeutic courses (45 EC) are in principle accessible for non-Dutch speaking students mastering English, e.g. as part of the pre-master bridging programme to enrol in the ES MSc. The international dimension of ES is covered in the programme both (1) binationally (Belgian-Dutch), e.g. in students' teamwork, faculty staff, and commissioners on BSc research involved, and (2) globally/internationally, e.g. in original English scientific source materials.
From 2019 onwards the OU plans to offer self-assessments and self-remediation on pre-BSc academic skills (www.ou.nl/studiecoach).

Orientation: intended learning outcomes
The programme's learning outcomes were defined using the qualifications at an academic environmental proficiency level of a professional with appr. 5 years experience (Lansu et al., 2006; Lansu, 2013, Appendix E1). Domain experts were involved in defining the environmental challenges that future professionals will face. Experienced lecturers translated these future challenges into intended learning outcomes. This design strategy resulted in a competence roadmap (Appendix E1) with the three competences diagnosis, research and intervention at the core of the curriculum. The BSc graduation level was derived from the proficiency level, on the basis of the Dublin descriptors (JQI, 2004; QF-EHEA, 2005, Appendix E2), as is the MSc graduation level. The BSc entry level was derived likewise by experienced lecturers, resulting in a learning trajectory of increasing competency. Although the diagnosis, research and intervention competencies are addressed in all study phases, the focus shifts from diagnosis, research orientation, knowledge and applying knowledge of natural sciences in the propaedeutic phase, towards research and reflection on intervention strategies in diverse environmental research domains in the post-propaedeutic phase (visualisation in Appendix F1.2).

Based on lecturers' experiences, these fairly generic competencies were further developed into a set of 40 learning outcomes, which, following the Dublin descriptors, were organized in 5 classes: (1) knowledge and insight, (2) applying knowledge and insight, (3) making judgements, (4) communication, and (5) learning skills. These learning outcomes act as a reference frame for the development and implementation of the curriculum, and as such they are a regular topic of discussion in the programme cmte, curriculum cmte (lecturers), educational cmte (other MST programme leaders) and the external advisory board. The learning outcomes are listed in Appendix E2 and are summarized in Table 1.

Reflection on Standard 1
The current learning outcomes were formulated in 2006 and are due to be updated to more generic learning outcomes. This update was scheduled for 2016. However, due to the programme's many changing dimensions, the current learning outcomes have been retained, in order to meet academic and educational quality. We decided to postpone (opleidingsplan 2016-2019) revising them to autumn 2018 when developing the BSc 2019-2022 programme plan. As suggested by the previous assessment panel they will be reduced, and new developments and concepts like socio-ecological systems theories (or human-environmental systems analysis), energy transition practices and resilience methodologies on climate change and urbanisation, will explicitly be considered for inclusion. The update process has already been initiated by discussing the current learning outcomes during a meeting of the external advisory council.

Standard 2: Teaching-learning environment

Curriculum
The curriculum (Appendix F1.2) covers all learning outcomes (see cross table in Appendix E2). It consists of two phases: (1) a propaedeutic phase (with propaedeutic certificate) and (2) a post-propaedeutic phase: the 2nd and 3rd BSc year (with BSc degree at completion).
The nominal year schedule (Appendix F1.1), based on a part-time study pace of 30EC/yr, has clearly structured the curriculum. The three formal bachelor years are six part-time study years. In most of these part-time study years, four courses with quarter term cohorts and two courses with semester cohorts are scheduled. Cohorts in quarter term courses have a fixed date of start. Students could start a semester or 'variable' course as a cohort or as self-regulated learning (flexible in date of start). The resulting flexible structure allows for a study pace of 30, 20, 15 or 10 EC per year, allowing students to slow down or accelerate their studies by rescheduling the semester courses. Didactic and assessment design principles have been integrated in the design of the renewed curriculum (Appendix F1.3).

Propaedeutic phase, 1st year BSc
The propaedeutic phase is characterized by an integrated, natural science perspective on the earth system and the disturbance in relationship to the environment and society. The emphasis is on achieving learning goals in the diagnosis competence mainly in the science domain but with emphasis on governance and human-environment interactions, also part of the research competence (Appendix F1.2) .
New enrolments start the propaedeutic phase (BSc 1st year) with a full day at *Burger's Zoo***,** Arnhem. While working in teams on analysing and presenting a first case study on ecosystems, they also learn academic study skills and get to know peer students, tutors and the study advisor. This day, also open to new applicants not yet enrolled, is part of the introductory semester which starts twice a year: in autumn with *Aarde, mens en milieu 1 & 2 (AMM1 and AMM2)* and *Wiskunde voor milieuwetenschappen*, in spring with *AMM1 & AMM2 and Geologie rondom plaattektoniek.*
From now on we will discuss the nominal study scheme (start in september, 30EC/y) as shown in Appendix F1.2, while keeping in mind that appr. 2/3 of the degree students study with exemption by means of a personal study path built on scheduled courses as building blocks, mentored by the study advisor.

The *AMM1 & AMM2* courses provide students with a common reference frame in the environmental sciences (ES) in which the knowledge domains of ESS are integrated (Appendix F1.2). *AMM1* introduces students to the natural processes and dynamics taking place within the earthly environment, with learning goals directed to achieving the diagnosis competence in the natural sciences. *AMM2* teaches students to handle terminology on environment and sustainability (ES), study the impact of human-activities on the environment, and learn to structure and analyse environmental problems using the European DPSIR framework. Learning goals are thereby directed to achieve diagnosis and intervention competences on human-environmental systems.
In both *AMM* courses students meet in regional or online groups, to stimulate academic discussion and to optimally use peer feedback on 'back to study' and remediation needs. In the *Wiskunde* course, the mathematical insights and skills are practiced on the basis of the required theoretical foundation with many concrete examples from the environmental science practice. In the *Geologie* course the insight into the earth system from different natural science disciplines and the interaction with spatial processes in the subsurface, is practised by students in poster presentations face to face at the thematic day or during online classes.
After the introductory semester, the propaedeutic students delve deeper into the natural sciences through courses in *life sciences, physics and chemistry* with plenty applications on the environmental sciences. In the 2nd semester of year 1.1, with the quarter term courses *Levenswetenschappen: evolutie* and *Scheikunde voor milieuwetenschappen 1*, and the semester course *Geology* and in year 2.1 with the courses *Levenswetenschappen: fysiologie* and the science lab *Geïntegreerd practicum natuurwetenschappen.* The parallel semester course *Gegevens en gevolgtrekkingen* introduces students to scientific reasoning and statistics as an instrument for collecting reliable evidence, meanwhile discussing the societal function of science. In this semester three courses are scheduled concurrently (Appendix F1.1) to accommodate students taking the science lab *Geïntegreerd practicum natuurwetenschappen*, scheduled over five full mid-semester days at a Wageningen Universiteit Laboratory (with WUR staff, and OU lecturers on *fysiologie* and *scheikunde*). The other two courses temporarily stop during that week to allow for the fulltime lab work.

The end of the propaedeutic phase focusses more on achieving the research competence (Appendix F1.2). The quarter term course *Natuurkunde voor milieuwetenschappen* teaches students to use the physical principles and to place physical phenomena in an environmental scientific context. The integrating study task on the climate system confronts them with how different facets of physics can contribute to a better understanding of our climate and climate change. In the quarter term course *Milieubeleid: theorie en praktijk* students work in teams on the theory of environmental policy and governance while analysing practical multi-stakeholder problems, reporting findings and discussion on the youlearn forum. The semester course *Milieuwetenschappen en duurzame ontwikkeling* is a key course in the programme and is also mandatory to students of BSc transfer programmes and non-environmental pre-MSc bridging students. This integration course on defining and analysing environmental issues focusses primarily on (learning) academic writing skills.
On the basis of a - self-proposed - environmental problem, important aspects of scientific reporting are introduced, worked on and related feedback discussed in online classes.
After completing the propaedeutic phase, the student can apply for the **propaedeutic certificate**.
During the propaedeutic year, the emphasis is on the development of diagnostic and research competencies. A large part of attention in the programme is paid to acquiring the required knowledge and insights, to applying knowledge, and to forming judgments. In 2013, the intervention competence and communication and learning skills during the propaedeutic phase were less developed. This has been improved in 2017, through the embedding of an environmental policy course *Milieubeleid* in the propaedeutic phase, in which policy analysis as group work plays an important role, and through the introduction of active working methods in cohorts which stimulates discussion and scientific reporting on studied issues.
In the propaedeutic year , all course materials are tailor-made in guidance on self-regulated learning, were developed in OU course teams, tutored through (online) meetings by our lecturer-researchers, and supervised by the full professors.

Post-propaedeutic phase 2nd year BSc
Based on a sound foundation in natural sciences and propaedeutic research skills, the **2nd post-propaedeutic year** (Appendix F1.2) offers a broad range of thematic courses in environmental sciences (35EC). Each ES thematic domain and respective course covers intended learning outcomes on both the diagnosis competence (problem definition) and the intervention competence (solution and strategies). This 2nd BSc year starts with a semester of integrated, thematic courses on *Systeem aarde: kennis voor klimaat* (starting Sept 2018) and *Voeding en gezondheid* together with a science course *Scheikunde voor milieuwetenschappen 2*. Other thematic ES courses in this 2nd BSc year are on *Ecosystems and Human Well-being*, *Environmental Toxicology* (starting April 2019), and *Bodem en water; een stroomgebiedbenadering.*
This phase focusses more focus on achieving the research competence. Students learn (15EC) to use research methods and tools on *Geographical Information Systems (GIS)*, *Environmental Systems Analysis and Scenarios* and on *Regional Governance - Policy Analysis, Evaluation and Design*, through theoretically underpinned practical home-assignments.
In the final semester of the 2nd year, students work in the *virtual environmental consultancy* setting *(Virtueel milieuadviesbureau 1: onderzoeksmethoden, 10EC)* on a research proposal on topical themes of the department's research groups. The focus on a proposal, not intended for development into a thesis research project, encourages creative thinking in problem analysis and research set-up.
In this 2nd BSc year, 2nd year besides diagnosis and research competence, also the intervention competence is explicitly covered in the thematic courses (Appendix F1.2). Compared to the propaedeutic phase, this phase focusses on the application of knowledge and insight and on judgment, and less on the acquisition of this knowledge. In 2013 the attention for communication and learning skills was limited to more passive communication tasks. In 2017 this was improved: tutors redesigned the quarter term courses in the new curriculum with active learning methods and formative and summative assignments based on academic skills (Appendix F4). The embedding of a new course on research methods (*Virtueel milieuadviesbureau 1: onderzoeksmethoden*) in this phase, directed to writing a research proposal, helps students to enhance these research competences in a structured and supportive way. This integration course incorporates several oral and written assignments on scientific reporting, including student peer review and writing a rebuttal.

Post-propaedeutic phase 3rd BSc year
In the final post-propaedeutic phase, students have sufficient opportunity to connect the formal study scheme to their own (intended) work field or research domain, by free electives (30EC) and by self-proposed assignment topics within core curriculum courses (15EC) and in the research themes of the bachelor's thesis (15EC).

Students are allowed to study free electives from other OU BSc programmes, or as 'contract education' at other (international) academic BSc programmes. So far, the option to choose for 'contract education' at regular Dutch universities has some financial (as recognized by VSNU) and personal drawbacks (time/pace constraints). So far, only two students (2013-2017) have requested and received approval for 'contract education' as free elective, but did not enrol. The majority of our BSc students have a full exemption on the free electives, because of formerly gained HE certificates: thus their former HE is their specialisation and expertise.
In the final year, the thematic ES courses are on *Voedselveiligheid*, *Environmentally Improved Production* and *Corporate Responsibility for Sustainable Development*, each with assignments on written scientific reporting in either Dutch or English (student's choice).
The BSc thesis research is part of the *Virtueel milieuadviesbureau 2: BSc afstudeeronderzoek*. Students work in teams (of four, with one tutor) on topical research orders commissioned by professionals in the ES work field (Appendix H4). In the team work plan, the students define, in consultation with external commissioner and tutoring staff member, their individual work packages for delivering as thesis product both an individual report and a team advisory report to the commissioner.
After completing the post-propaedeutic phase, the **Bachelor of Science certificate Environmental Sciences** is awarded as a recognized diploma and admission to, among others, a scientific Master's program in ES.

Variants of bachelor
We offer two pre-MSc bridging programmes, individually matched on domain and level of the student's former diploma, for entry into the MSc ES. The pre-MSc bridging programme 'Research' for hbo-BSc ES consists of two dedicated pre-MSc courses: *Research approaches in environmental sciences* and *Virtueel milieuadviesbureau: Premaster*. These courses are structured to enhance research competences and academic skills. Students learn the essentials of a research proposal and research report through oral and written assignments on scientific reporting. The pre-MSc ES bridging programme builds on the regular BSc programme courses, and aims to bridge students without an ES BSc. Both pre-MSc's can be combined in case of both research and environmental sciences deficits.
With the two pre-MSc bridging programmes, the potential transfer to the MSc has increased: the number of admission requests (transfer, pre-MSc or direct admission) has increased (2017: 59, 2016: 42, 2015: 25, 2014: 7). Though the number of enrolments on the pre-MSc courses 'Research' for hbo-BSc graduates is lower than expected, it is increasing (2017: 12, 2016: 10, 2015: 5). The number of enrolments on the pre-MSc ES is unknown, as these are regular BSc courses.

Competence-based learning trajectory
Overall, the BSc curriculum shows a balanced division between the diagnosis, research and intervention competences on one hand, and the five Dublin descriptors on the other. In 2013, the 3rd BSc year focussed more on communication and learning skills (compared to 1st and 2nd BSc year), and less on the acquisition of knowledge. From 2017 onwards, the acquisition of knowledge and research skills is improved by new courses on regional governance, climate dynamics and adaptation, integrated environmental modelling and human and ecotoxicology. We will continue to update and strengthen both the knowledge base and the research skills in the renewed curriculum. The active learning tasks in the various cohorts offer ample opportunities for strengthening research skills, by means of scientific reporting and peer review assignments. The rich diversity in (career) expertise of the collaborating students provides a fertile ground for describing, analysing and proposing solutions for contemporary environmental issues. This peer-to-peer collaboration is binational (Dutch-Flemish), with related cultural differences, but not international nor with international students.
Another learning trajectory in the programme focusses on personal development through reflection and peer-reviewing. This trajectory consists of individual tasks on learning objectives integrated in the introductory courses AMM (BSc 1st y), followed by peer-reviewing and reflection upon further study and career in the thesis preparation (BSc 2nd y)and the thesis course (BSc 3rd y).
Another learning trajectory is the embedding of academic competences throughout the programme, starting from the Burgers' Zoo ecosystem poster presentations, via diverse assignments in post-propaedeutic quarter term courses, to the final BSc thesis. The use of English gradually shifts from passive English in propaedeutic courses to active, written English in the final post-propaedeutic phase (*Corporate Responsibility on SD*).

Study advise
The student consults the study advisor at least four times in the BSc, although we advise a yearly consultation. A first consultation is at enrolment at Burgers Zoo (starting day, or as a task in AMM1), to discuss the matching of learning goals and study

plan. A second consultation is at the start of the science lab (BSc 1st y), and the final two are at the start of the BSc 2nd and BSc 3rd year virtual environmental consultancy courses. Students can contact the study advisor more often, f.e. when choosing free electives, for advise on applying for an exemption or approval of contract education. Students with a disability or chronic illness may request additional provisions.

Admission
The OU uses various channels e.g. ads (National geographic, internet, radio and TV), to inform potential future students on the BSc programme, and through the OU website, the OU study centres and information markets. Interested students are provided with an online magazine and a study guide on the programme. All students that wish to do the programme can contact the study advisor for a study plan fitting capacities and learning objectives.

Didactic design
The majority of students starts their studies at the OU with the intention to obtain a degree. In practice, this is not a simple task. Especially for part-time BSc students with open admission, obtaining a degree requires sustained and unremitting discipline over a long period of time. In order to better support students' ambitions to complete a degree programme and to improve study success, the OU developed the didactic model yOUteach: structured by tasks, and aimed at stimulating active study behaviour in cohorts. The new in-house learning environment yOUlearn, that was introduced at the time, incorporates a system for tracking student progress. The learning environment is continuously updated, at the instigation of its key users (tutors and students) in the BSc/MSc programmes.

Quality assurance
The quality assurance system has also changed in line with the Institutional Quality Assurance Test (2015/2016), in which this ES BSc degree programme was described and audited as 'good' in the Audit Trail on bachelor QA. The system is based on closing the plan-do-check-act-loops on course (by examinator), programme (by programme leader), faculty (by the MST education coordinator) or university level (CvB). At programme level, each course is developed on the basis of a course plan outlining learning objectives, course structure, learning methods, learning materials and assessment procedure. Developed by a course team, the draft course plan is discussed in a bimonthly curriculum cmte meeting. Draft plans of all courses are developed and discussed from 2016-2018, on basis of the *opleidingsplan 2016-2018*. The didactic design and assessment model of the course is directly related to its academic level, which is determined by a determination instrument is used (Appendix F1.3)

yOUlearn
Tutors have implemented Bsc. courses in the online learning environment yOUlearn. Each course website in yOUlearn typically consists of general information (e.g. course schedule, examination, tutors), announcements, a course structure, a discussion platform and a virtual classroom. The course structure, the heart of the course, consists of learning tasks and is an implementation of the didactic design of the course. These predominantly weekly learning tasks, tailored to their learning goals, direct students to a task instruction on the contents (reading texts and assignments) and accompanying documents like templates. Learning tasks can also be used to submit drafts, questions, and final assignment papers to the tutor. A tutor has ample possibilities to design in-course formative self-assessments and assignments with feedback. Apart from a roster structure and assignments, the platform also has functionalities for monitoring student progress and facilitating group work. Where considered useful and feasible, course content is provided both in hard copy (OU course maps) as well as digitally (PDFs in yOUlearn).

Tutoring
Over recent years, all BSc courses have been redesigned to fit the new educational concept (Appendix F5) or are newly designed and developed. Thus all old 4.3EC (or 8.6EC etc) courses have been transformed into 5EC courses (or 10EC etc.), following new OU guidelines on study load and methods. This innovation focussed on the introduction of active learning, structuring courses in study tasks, and intensifying contact amongst students and between students and tutors. The core of most courses still consist of self-regulated learning, supported by the option to pose questions to peers and tutor on the course's yOUlearn forum. Furthermore, each course now has at least four contact moments, e.g. three online lectures and a supervision session during one of programme-specific thematic study days in the OU study centre in Utrecht (Appendix F5) that are organised four times a year. The OU has 21 study centres in the Netherlands and Flanders, which are, furthermore, used as information desks, for examination and a variety of (progress) meetings.

Staff
Almost all staff members responsible for a BSc course have a PhD degree and 86% of staff has a university teaching qualification (UTQ/BKO) (Appendix F9).

Didactic skills are maintained through a system of permanent education (PE). Staff members have to do 120 hours of educational training every three years (on a fulltime basis) to maintain and further improve their didactic skills. Practically all staff members are, in connection with the changed institutional vision, actively involved in scientific research and publish on a regular basis (Appendix F7), with some student publications following BSc assignments (Appendix F8). The overview of staff members (Appendix F9) also indicates their main areas of expertise, covering fields such as environmental modelling, energy, climate change, toxicology, risk assessment, (micro) plastics, learning for sustainability, innovation and governance.
Based on staff and course enrolment data from 2016, the staff/student ratio for the BSc and MSc programmes combined was 1 to 13. This estimate was calculated by assuming that staff members spend 60% of their time on teaching. Since 2016, the staff has been reduced from 14.0 fte to 12.6 fte.

Information provision, progress monitoring and student facilities
Each year, all students enrolled in a BSc course receive a study guide containing information on the programme and its organisation. The BSc programme portal in yOUlearn, provides additional information on the faculty, the BSc programme in general (study guide), courses, admission, the yearly schedule, student experiences, seminars, scientific integrity, tips for improving academic literacy skills, study counselling and other student facilities. Study advisors and programme leaders put announcements on this portal, on which students and staff get alert emails. The university has a weekly student newsletter and bimonthly online magazine *Modulair* with a short separate section per programme and regular journalistic interviews of ES students and alumni. In case of questions on the programme, students are encouraged to contact our faculty-based study advisor, at the central information point of the OU, info@ou.nl, allowing study advisors to quickly give expert advise on enrolment, costs, disabilities, examination, transfer programs. Students are generally content on information provision (score 4.05 on a 5-point scale; Munckhof et al., 2015). Social media such as Twitter and Facebook are increasingly used to inform students on content-related topics. Options to further personalize the information provision to and communication with students are being explored by the OU (i.e. through social media and yOUlearn).
Student progress is monitored within individual courses in yOUlearn, as well as over the entire BSc programme. Within a course, progress is either monitored on a voluntary basis (e.g. students tick a box after completing an assignment) or by means of assignment submission. Progress over the BSc programme is monitored during the yearly consultation with the study advisor. During the study, students have access to various facilities, such as f.e. the OU study coach (www.ou.nl/studiecoach) which provides several online and hands-on courses to enhance students' study skills. Furthermore, students have access to the online library, linked to the Maastricht University Library, with an extensive number of bibliographic databases, online journals and e-books.

Evaluation results from students and alumni
The most important findings of the yearly OU student's survey over 2013-2017 are summarized in Appendix H6.3 and of alumni in Chapter 4. Comparison between years is complicated by the variation in questions, scales and surveyed groups. Overall the evaluation results show that students are generally positive about the programme, content, coherence, topicality, supervision, staff, information provision and facilities like the digital learning environment and the library.
The results of the National Student Survey (NSE) over 2014-2017 show similar results with a first rank (out of two) for the BSc programme. The Keuzegids Universiteiten, comparing all Dutch (WO) Bachelors, top-ranks the BSc programme in 2015, 2016, 2017 and 2018 (Appendix H6.1), and the Keuzegids 2015 names the OU as 'Best University 2015' on bachelor programmes.
Because of the heterogeneity of the students and the large variety in their individual learning paths in contents, order and size, data on the studability of the programme are difficult to provide. An indicator of the effect of programme changes on study success are the course efficiency rates (Appendix G2). Whereas the success rate of course assessments remains more or less equal over the years 2013-2016 (1st BSc yr 84%, 2nd BSc yr 86% and 3rd BSc yr 88%), course efficiency rates increase with 15 to 30% from 2013 (1st BSc yr 39%, 2nd BSc yr 28%; and 3rd BSc yr 25%) to 2016 (1st BSc yr 54%, 2nd BSc yr 52%, 3rd BSc yr 55%).
Unique is that there are no entry requirements for enrolment in the BSc ES courses, not even a 'nature' profile requirement. For (almost) all comparable scientific bachelor programmes, the entry requirement is VWO with a profiling requirement on nature, technology or health profiles ('N + T' or 'N + G'). This unique feature of the programme with possibilities for a OU propaedeutic certificate to enrol in STEM programmes could be an option to attract a

new target group. The evaluation results are unique for STEM programmes (Lansu, 2013): the learning outcomes for 2000-2012 are good and equal across women and men (in 2014 inflow of 40% women): the high percentage of completion of the BSc thesis (87%, SD 8.4) supports these good learning outcomes. It is advisable to indicate the ES BSc more in this context and possibly to take part in incentives on strengthening STEM education and female enrolment in STEM programmes.

Reflection on Standard 2

The OU BSc programme in Environmental Sciences offers a coherent and topical curriculum built around a student-activating didactic concept for efficient part-time distance education supported by a simple and student-friendly new digital learning environment (yOUlearn). Less flexible than the old system, this new system implies a higher degree of obligation from students. The link with active research was strengthened over the last few years and the aim is to strengthen this link further. Although student enrolment, follow-up enrolment and course efficiency rates have increased over recent years, the aim of 20 graduates/year has not yet been realized. This is needed to optimise efficiency and maintain sufficient critical mass for education and research, particularly within a faculty where other programmes have much higher student numbers (e.g. >200/year) . Staff is qualified and engaged, but experiences a high work load. Recent reductions in staff have not been compensated by the faculty, resulting in a net increase of working load per staff member. There is currently limited capacity for innovation of programme content and actualisation of intended learning outcomes as part of the programme plan 2019 and beyond. Information provision to students is good, but could be personalized further: the introduction in 2016 of a programme-based study advisor is a first step in this process. Student exchanges with free electives of other universities remain low, as the OU's course-based tuition fee mismatches with the year-based fees in the rest of Dutch HE. The VSNU chair recognizes the problem, but indicates it as a tough game, to be played at many VSNU tables at the same time. The same holds for MOOCs, both MSc and BSc programmes are in consultation with WUR, Delft, and Utrecht in 2018.

Table 1 Intended learning outcomes of BSc Milieu-natuurwetenschappen, summarized on Dublin Descriptors

Intended learning outcomes per Dublin Descriptor
Knowledge and understanding: Building on the level of secondary academic education, the bachelor graduate has knowledge and understanding of relevant scientific disciplines (life sciences, chemistry, earth sciences, and physics) and supporting subjects (mathematics and statistics). In addition, the bachelor graduate has knowledge and understanding of the nature, the scope and causes of environmental issues, the methods to investigate them (experiment, modelling, data analysis) and to intervene by offering possible solutions (technical, policy). In addition, the bachelor graduate has understands the concept of sustainable development and is aware of relevant international developments within the discipline.
Applying knowledge and understanding: The bachelor graduate can recognize and describe an environmental problem scientifically. The graduate is able to contribute, both in a team and with individual support, to the design and execution of environmental scientific research and can select and apply relevant research methods. The bachelor graduate can apply the acquired knowledge and insight in formulating possible solutions for environmental issues.
Making judgements: The bachelor graduate is able to select and interpret relevant sources and data, and is able to perform a substantiated assessment of the usability and reliability. The bachelor graduate can formulate its own problem statement and research question, with respect to other environmental sciences research and within the associated social context. The bachelor graduate is able to form a well-founded opinion on possible solutions for environmental problems and to place them against the background of the concept of sustainable development.
Communication: The bachelor graduate can, with support, both in a team and with individual support, contribute to written and oral reports on an environmental science problem, to the results of research and possible solutions. The bachelor graduate keeps in mind, the core of the research question and the intended target group (specialists and / or non-specialists). Based on a broad environmental scientific knowledge base and an interdisciplinary attitude, the bachelor can cooperate constructively within an interdisciplinary project or research team and deal with commissioners, clients and experts.
Learning skills: The bachelor graduate is able to reflect on its own study and work, and that of others, and is able to draw conclusions for future actions. The graduate is able to make responsible choices for further learning and is aware of the opportunities within the labour market for environmental scientists.

Standard 3: Student assessment

Assessment policy
The assessment policy of both programmes (BSc and MSc) is described in an assessment policy plan (Faculteit Natuurwetenschappen, 2013) which is elaborated and reflected upon in the yearly programme report. The assessment policy is implemented by means of various testing methods, such as written tests, presentations, and research reports for assessing learning outcomes. The course examiner makes the exams, defines the answer model with caesura, or marks candidates' work and determines the final grades, with the deputy examiner as co-assessor in case of doubt, or in case of grade 1 or grade 10 (examiners: Appendix F8). The organization of written tests at each study centre in either exam weeks or daily computer based sessions, is done by the OU examination service department, which is accountable to the faculty's Exam board. With the yOUlearn cohort system, the exam weeks have been rearranged: August re-examinations of the April-July quarter term have been limited, despite students' practices of studying in the summer. The assessment method used by course examiners depends on what content is tested at what level and for which aims (Appendix F1.3).

Summative assessments: Each BSc course ends with a graded summative test, to assess if the student has reached the course's learning objectives. These tests, as described per BSc year in this chapter, are for grading and certification. All summative tests are developed by the course team, involving at least both examiner and deputy examiner, and often also (external) authors/lecturers. The course team publishes two trial work outs/sample exams of each summative assignment on the course site. The remark of the 2013 visitation on the temporal validity of course certificates, at the OU infinite, is not under discussion at OU level.

Assignment profile and adjustments: In the development phase of the course, the course team defines the assessment profile, as part of the course plan, which is discussed in and adopted by the curriculum committee. Major changes in assignment type, method or objectives require a renewed assessment profile as part of a new/renewed course plan (linked with a revised course code). The assessment profile, a compulsory document for the MST Exam board, explains type and method of the assessment and how it ties in with both course objectives and, as from September 2018, with programme learning outcomes. As all BSc courses are newly developed or renewed, all assessment profiles have recently been (2016, 2017) discussed and formally adopted.

Grading. The learning objectives to be tested and the associated grading criteria of summative assessments are always accessible for students from the start of the course onwards. The OU Examination regulations (on line on website) explain standard grading rules and caesura for passing written tests (multiple choice and open). Also institutionalised at OU level is the publication of preliminary answer models of written tests in an exam week, within 3 days of examination, together with information on how to report to the examiner manifest errors in the exam, or how to file an appeal. All written multiple choice tests are automatically analysed and outcomes are reported to the examiner, who may or may not decide to adjust the preliminary answer model as a result. In case of written exams or assignments, both examiner and deputy examiner grade independently the first 10 exams of a new course, to derive an answer model.

The examination board of the faculty checks the quality of student assessments in four-year cycles, one type of assessment per year. Reliability and viability is also safeguarded by involving two or more experts in the grading process: standard is the examiner, and in case of doubt the deputy-examiner. Theses of the 4 MST BSc programmes were checked for the first time in the study year 2016-2017. A sample of anonymized MST BSc theses was assessed by independent assessors, i.e. faculty staff members. This process will be improved by allowing some more assessors, from similar domains.

Fraud and plagiarism. All work submitted by students must meet the general criteria for scientific integrity, e.g. it must be their own work (no plagiarism, no fraud), original information sources must be cited correctly and data (analyses) must be verifiable. Awareness of these criteria is taught and explicitly discussed in formative assignments, where we refer to both instructional tests with APA guidelines on scientific reporting on the BSc portal, and to the MST exam regulations on fraud and plagiarism. Where appropriate (Appendix G1), students must include a '*Declaration of originality*' when submitting a summative assignment test. Moreover, the tutor checks for originality using antiplagiarism software.

Propaedeutic year
In the BSc propaedeutic year, written tests (multiple choice and/or open), focusing on knowledge and understanding, are mostly used (Appendix G1) to assess if the student has reached the learning outcomes. These tests are sampled from a database containing 8-10 times the number of questions in the exam. The database of items has been double-checked by both examiner and deputy-examiner. Where appropriate, the written test is implemented as a **computer based session** (multiple choice and/or open), which can be individually planned and taken by the student on a year-round daily basis at each study centre. In long-answer open questions tests, (hand) written tests (math, chemistry) are scheduled in **exam week sessions**, at all study centres. For courses teaching ES research competences, the summative test is a written research report.

In the propaedeutic phase, a trajectory of summative research reporting is implemented in the curriculum in the *Science lab* course, *Milieubeleid* and finally *Milieuwetenschappen&DO.* In *Milieubeleid* the team result are presented in a written report and summarized in a presentation. Both team products are part of the course's (individual) final assessment, in addition to an assessment of the group process and each students' individual contribution. This is a **team assignment**, since working in teams is an explicit learning outcome of the bachelor programme. The *Milieuwetenschappen&DO* **individual assignment** assesses the extent to which students master the integration of propaedeutic knowledge and understanding by (1) defining and analysing a current environmental problem on the basis of literature sources, and (2) processing the findings and conclusions into an essay at academic level.

Post-propaedeutic phase
Most common in 2nd and 3rd BSc year courses is a graded summative exam, integrating the testing of complex academic competences. A (graded) summative test can consist of multiple intermediate and final tests (Appendix G1). Most common is a combined **written** (graded, focusing on knowledge and understanding) and **individual assignment test** (which you either pass or fail), or a combination of intermediate (pass/fail or graded) and final assignment tests (graded). Most summative assignment tests are individual.

BSc graduates are expected to be able to give **presentations** in their field of expertise. Therefore, presentations are a suitable form of testing, and, as described above, are implemented as part of summative assignment tests in some research reporting courses, at instruction sessions online or at a thematic day.

BSc thesis research – the final project - is assessed in the 2nd BSc year thesis preparation course and in the 3rd BSc year in the BSc thesis itself. Standard 4 describes how it tests the achievement of the exit level.

Assessment success rate
Appendix G2 provides an overview of the success rates (also referred to as pass rates) of the different BSc courses over the last 5 years. Overall rates are sufficient on a 2013-2016 mean of 84%, 86% and 88% in the three BSc years. What stands out is that several BSc courses with written report assignments have a success rate of 100%, whereas related course efficiency rates (also referred to as course yields) are (far) lower. This high success rate can be explained by the way assessments are handled in these courses: students submit a draft final assignment for feedback and later on submit a revised final version as the (summative) final assessment. This practice has been discussed with programme staff and it has been decided to separate formative from summative assessments wherever appropriate. The yOUlearn system offers different tools for both types of assignments, thus make clear if an assignment is formative or summative.
The effect of design parameters (degrees of freedom; DoF, Appendix G1.2) on course yield (CY, %) is shown in the 2013-2016 mean data. The average CY of 'fixed' courses (57%) tends to be higher than of variable courses (43%). Courses with a scheduled programme (cohort system) have a higher CY (53%) than non-scheduled courses (39%).

Reflection on Standard 3
The BSc programme has a transparent and objective system for student assessment. Each assessment method is tailored to the course's learning objectives and the programme's intended learning outcomes. Students have ample opportunities to practice tests. Multiple staff members are involved in the development of tests and/or grading. Programme management has implemented a stricter distinction between formative and summative assignment tests, in which yOUlearn is helpful. The number of exam attempts, which was infinite up to 2015, has now been limited to a 12 month registration period with 3 exam chances, the first of which is compulsory. Fixed dates of enrolment and scheduling of courses into a cohort system has helped students to study and finalize courses more quickly, as shown by the fact that course yields increase.

Standard 4: Student assessment

Results of tests
All BSc students are summatively tested on the achievement of the learning objectives stated for each course in the programme. Programme policy is that all BSc courses are completed with a quantitative grade as an integer between 1 and 10 (a zero score is not allowed in OU grading). Not quantitatively graded are courses ≤2.5EC (either pass or fail) which only applies to the *'Capita Selecta'* courses, based on an individual agreement (by the dean).

Certificates
The **BSc diploma certificate** is awarded to students according to the following compensatory rule per phase (propaedeutic and post-propaedeutic): for all courses a pass mark (≥ 6), with one mark '5' allowed (with the **propaedeutic certificate** awarded upon successful completion of the propaedeutic phase). The compensatory rule does not apply to the quantitative assessment of the key courses science lab, thesis preparation and BSc thesis. Testing for these key courses, with entry requirements, is informed by the intended learning outcomes at three successive levels (1st, 2nd , and 3rd BSc year). Since each BSc course covers part of the intended learning outcomes of the BSc programme (Standard 2), this automatically implies that the students have to masters these learning outcomes in order to pass.
Part of the post-propaedeutic phase are the **free electives** (30EC). As these are graded by the providing (external) examiners, we, as a result, have less understanding of students' achievements. That is why programme policy stipulates that students can only take electives at an academic BSc level, and in practice, this only applies to degree students studying without any or with minor exemptions. Most students choose courses from the other OU bachelor programmes as elective (extern OU see: Appendix F3) with comparable test regimes and accountability to the OU faculties' exam boards.

Grading table
The grades obtained by the BSc graduate, and published on the diploma supplement, reflect the level at which the learning outcomes were realised by the student. To enhance (international) comparability of grades, the OU, since September 2017, provides an addendum with each BSc/MSc degree specifying the relative distribution of course grades. This 'Dutch grading table' (Appendix H2) show the relative distribution of the unweighted grades obtained by BSc students for all our BSc programme courses, over the previous 3 years. The current modus of 7 is considered to be a reliable distribution.

Final project
BSc thesis research – the final project - is assessed in the 2nd BSc year thesis preparation course and in the 3rd BSc year in the BSc thesis itself. The BSc thesis assessment protocol guarantees the academic level of the work performed. Both courses consist of multiple individual and group assignment tests, since working in teams is an explicit intended learning outcome of the programme. Contributions of individual team members are specified and tracked: each student submits an individual reflection report, research report and a final team report, which are used for differentiation in grading between individual group members.
One of the rules is that all work must be supervised by at least one supervisor with a PhD degree and, at the client commissioning the research order, one with a MSc degree. Commissioning is done without any financial transactions and with no guarantee on final quality, as it is a learning research project. Furthermore, both the examiner and the BSc programme leader review and comment on all clients' research orders, before acceptance. This is done with regard to suitability of the research order to fit with the level and discipline of environmental sciences and the 'research richness' for a team. Students present the draft findings of their thesis orally at three successive presentation sessions, and are given feedback by all students present and 2 or more lecturers. The final team research report (the thesis) is also assessed by the external commissioner, as part of the grading. Over 2013-2017 appr. 14 graduates per year were awarded a **BSc certificate** (Appendix H1) and appr. 20 students a **propaedeutic certificate** (2013-2016). The final project, the thesis research assessment, consists formally of the courses *Virtueel milieuadviesbureau 1: Onderzoeksmethoden* (10EC, 2nd BSc year, spring semester) and *Virtueel milieuadviesbureau 2: BSc Afstudeeronderzoek* (15EC, 3rd BSc year; autumn semester). Enrolment over 2013-2017 is appr. 18 students per year, with on the whole 1 drop out (mainly due to life events), and appr. 3 students who do not pass within the set 12 months (Appendix H3). The average grade awarded to the BSc thesis course (7,5 SD0,9) over 2013-2017 is stable, consistently high, and comparable to the1998-2013 data (7,6 SD0,3) (Lansu, 2013). Per September 2015 enrolment duration has been reduced to 12 months, the 2013-2017 12-month course efficiency rate of 72% increased to >86% in 2016-2017, an indication of more in-time completion.

With regard to the total BSc programme (please see Standard 2), the mean course efficiency rates per year rise from 39% for 1st BSc yr, 28% for 2nd BSc yr and 25% for 3rd BSc yr in 2013 with 15-30% to 54% for 1st BSc yr, 52% for 2nd BSc yr and 55% for 3rd BSc yr in 2016 (Appendix G2).

An overview of the final projects 2013-2017 (Appendix H4) lists per year: the title of the team advisory report (thesis), the students (by number) who co-authored the team advisory report, the grade by the examiner/tutor (assessor) and the grade of the client (co-assessor) on the advisory report. Up to 2016, students without (HE) exemptions had to take a mandatory second thesis run: 8 students participated in two runs in 2012-2017. Research project gradings (2012-2017; 28 projects) by examiner/tutor (7,5 SD 0,8) and client (7,5 SD 0,8) remained stable and without differences. Any grading differences of ≥1,0 (research project 17, 27, 34 in Appendix H4) were discussed between examiner, client and programme leader to determine the reason. In case a team member did not contribute sufficiently and/or in time to the project result, (project 7, 8 and 17) the student completed the resulting trajectory individually. Appendix K lists all final BSc thesis projects 2013-2017, including the graduate's individual final marks on all related final marks and title of the graduate's individual workpackage report.

Performance of graduates in actual practice
Benchmarking of the final project assessment is inherent to the virtual consultancy learning model. This learning model involves client-student consultancy, tutor-student researcher relationships, and (students') peer-to-peer online collaborative work on current environmental challenges (Appendix H4). We described the model (Lansu, 2013) as one in which learners act as employees within the knowledge triangle of embedded cooperation amongst university, industry and government. On the one hand, students collaborate with fellow student researchers, guided and assessed by academic tutors. On the other hand, students receive guidance from the client of their project, including a co-assessment of their research project. within the public and private sector.
Another indicator of the level attained by the BSc students is the number of professional and scientific publications and presentations in which students participate (Appendix F8), indicating the their work suits professional demands.

Alumni
A survey on bachelor alumni 2013-2017 (28 respondents/61) provides an insight into the learning outcomes achieved (Münstermann *et al.*, 2017). Appr. 86% of alumni assess the programme as more than sufficient or higher (one assessment of insufficient). Unanimously they indicated as major yield of their study: 'I have further developed myself' (93%). Unlike the past (2000-2012: 38% continue to MSc), almost all alumni report to opt for a MSc degree; of which 68% actually started a MSc. The 32% that did not have as the main reason study break ($^1/_3$). Appr. 87% of the bachelor graduates is in paid employment (Appendix F3), most of them in consultancy (50%) Appr. one third consider themselves to be an ES professional. The share of SME and freelance is very low.
Current BSc graduates indicate 'second chance', the original OU mission, not relevant for their decision to study. Their main motives are 'to deepen knowledge in environment and sustainability' (86%), 'obtain an academic degree' (71%), 'working in a job that requires an academic degree in sustainability' (55%). Alumni are satisfied about the BSc programme's contents (82%), study guidance (71%), programme coherency (68%), possibility to combine study and work (68%), connection with current developments (64%), and adequacy of the preparation to the MSc (63%, 2 alumni dissatisfied). On the academic skills achieved, alumni are mostly satisfied with 'written reporting'(86%), 'critically evaluating scientific work' (86%), oral presentation (82%), 'concluding based on arguments' (82%), 'analytical and critical thinking' and 'problem solving capacity' (75%), 'writing scientific articles' (73%) and 'scientific reasoning' (68%). Lower scores are on 'collaboration with others' (68% satisfied; 11% not), 'methods and techniques of research' (54% satisfied, 21% not) and 'setting up and implementing research' (43% satisfied, 25% not).

Job market
Connection of the BSc programme to the job market is inherent to our working BSc graduates (*alumni enquête*), although, in Dutch society the academic bachelor does not qualify as an entry certificate for the job market. The high satisfaction scores of our, relatively young, BSc graduates shows its necessity on personal grounds.
Data on the ES job market are scarce. Data from Netherlands Statistics (CBS, 2015) show that the market's increase (from 1.8% in 2001 to 2.0% in 2015) is mainly driven by the sustainable energy sector. The environmental protection sector shows a decreasing trend mainly as a result of reduced government activity. The OU conducted a survey amongst potential employers in the ES field (Lansu et al., 2018). The results, based on appr. 50 respondents, provide an insight into the main tasks of academic professionals in ES, their strengths and weaknesses, the relative importance of different

types of knowledge and skills, and expected future developments. The professionals are working in a wide range of sectors and tasks. The major qualifications are knowledge of ES issues, solution-oriented thinking, cooperation in teams, dealing with uncertain data, judgement, oral presentation (Dutch), and participation in stakeholder processes and societal discussions, while technical and health knowledge, writing skills (English and Dutch), commercial skills and participation in scientific discussions are considered to be less important. Employers are divided on the weak points. New functions are mainly expected in relation to priority themes (energy, climate change, circular economy & healthy environment), and are also linked to big data, sustainability and corporate responsibility issues. Although the survey does not provide direct information of the achieved learning outcomes of OU BSc graduates, the present and future need for academic professionals with a broad training in the field of ES is evident, equally so that the programme in generally meets the needs of the job market very well.

Reflection on Standard 4

There is a clear system in place to guarantee that BSc graduates in ES master the intended learning outcomes. The level reached is reflected in the grading system. Alumni are generally satisfied with both the programme and the achievements realized by the programme. Alumni policy could be strengthened, i.e. by more carefully monitoring the career of alumni and the provision of career support where desired especially because of common study break between bachelor and master. The OU BSc programme matches the needs of the job market, but further optimisation and fine-tuning is required, e.g. around integrated themes (energy, climate, healthy cities, circular economy) and topics such as solution-orientation, innovation and big data (research themes within the MST faculty. In order to meet prospective BSc students' expectations better, and to enhance student enrolment from private sector, freelance and SME careers in particular, we plan to study the aims and early careers intentions of students as OU novice and non-degree students.

*Table 2 Grade average of graduates on BSc thesis course Virtueel milieuadviesbureau 2: BSc Afstudeeronderzoek **

grade	2012	2013	2014	2015	2016	2017**	mean (2012-2016)
mean grade/y	7,3	7,2	7,6	7,6	7,7	n/a	7,5
SD	1,0	0,9	0,8	0,9	0,7	n/a	0,9

*NB9906 and predecessors (till 2016: N5021n),
**year = year of enrolment in BSc thesis course; those enrolled in 2017 (sept) will be graded in spring 2018

Table Dutch grading table BSc Milieu-natuurwetenschappen

Dutch grading marks and percentages calculated over the past three years For: *Bachelor of Science in Milieu-natuurwetenschappen*					
Dutch grade:	6	7	8	9	10
Percentage:	4,5%	56,8%	38,6%	0,0%	0,0%